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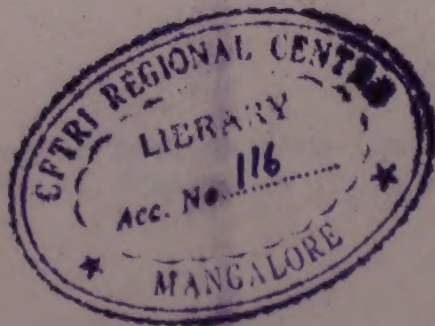
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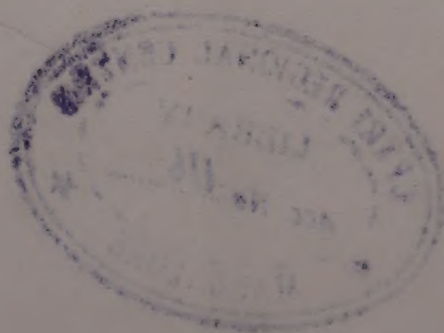
CODE OF PRACTICE FOR FRESH FISH



FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
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CODE OF PRACTICE FOR FRESH FISH





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CODE OF PRACTICE FOR FRESH FISH

GENERAL INFORMATION

This Code of Practice aims to assist all those concerned with the handling and processing of fresh fish, to ensure a high standard of product, acceptable to the consumer. The quality of the end product will depend on the practices and equipment involved, from the time of catching to retail distribution.

The primary problem in all fisheries is the maintenance of product quality, and this requires the careful execution of a sequence of simple operations. In principle, these involve careful handling and cleaning, rapid chilling and the maintenance of chilled conditions, minimum storage time, efficient, hygienic processing and speedy delivery to the consumer.

Fish catching and processing for human consumption is only profitable when the consumer is satisfied with the quality and price of the product. This situation requires the introduction of higher and more uniform standards of handling and processing to those in use in many areas of the world at present. The advice given here will help to raise and maintain a higher quality of fresh fish, acceptable in both national and international trade.

One aspect which requires particular consideration is the fact that different people in various areas, have different consumer requirements. Handling and processing practice, as advised in this code, will ensure that the quality standard of even the most sophisticated consumer can be met. Where prevailing quality requirements are less strict, handling practice may be more flexible, but advice which refers to hygienic conditions and wholesomeness of product allows for less flexibility, and the basic principles are generally applicable throughout the world.

The code deals with fresh fish for human consumption, which are chilled but not frozen. Where present knowledge does not allow firm recommendations to be made this is clearly stated. The information given here is based on the best technological knowledge currently available, and on basic principles as established in the light of modern research results. Both the knowledge and principles are applicable to all fisheries throughout the world and the code is therefore a guide to good practice in all areas, stating broad recommendations and explaining in simple terms the underlying reason for these.

It must be acknowledged, however, that most of the practical information in fish handling and processing, both at sea and on shore, has been gained from particular areas, mainly the North Atlantic and North Pacific fisheries. Little is known from fisheries in other areas, for example in the tropics. It should be appreciated that the variety of existing fishing vessels, the many different types of gear used and the number of species involved in world fisheries, do not allow for a single code of handling practice to be drawn up, covering all types of fisheries.

The practical application of this "international" code, with regard to "national" fisheries, will therefore require some modifications and amendments, taking into account local conditions and specific local consumer requirements. In other words, it should be possible for "national" codes of handling practice to be elaborated for the guidance of individual fisheries, based on this code.

The special requirements of retailing fresh fish are not included here, but these will be dealt with in a separate code. The recommendations generally apply to fresh water fisheries but these are not dealt with specifically.

No firm conclusions have been reached regarding the need for certain local practices, for example the removal of gills. Controversial matters of this type have therefore been omitted or mentioned without any firm recommendations being given. Similarly, super-chilling, that is the reduction of the temperature of the fish below -1°C (30°F) under controlled conditions, has also been omitted. It is thought that although this method of storage and preservation may be of considerable interest in some fisheries, there is not yet sufficient experience in the practice to permit a proper assessment of its value, or to give advice on how it should be carried out.

Food additives have been excluded from the code, since consideration of their use belongs elsewhere. No reference is therefore made to the use of antibiotics or chemical additives in ice or brine.

All operational codes of this kind will require to be revised periodically, to incorporate new developments and techniques, introduced commercially for the handling and processing of fish.

Definitions used in this code

Fish - includes Cyclostomes (lampreys and hag fish); Elasmobranchs (sharks, rays and dogfish) and Pisces (the bony fish proper). Aquatic mammals and invertebrate animals are not included. It should be noted, however, that many of the recommendations given here also apply to certain invertebrates, particularly Cephalopods.

Whole fish - are fish as captured, ungutted.

Gutted fish - are fish from which the guts have been removed.

Fresh fish - have either received no preserving treatment or have only been preserved by chilling.

A fillet - is a slice of fish, removed from the carcass by cuts made parallel to the backbone.

A steak - is a section of fish, removed by cutting approximately at right angles to the backbone.

Keeping time - refers to the length of time that fish will remain wholesome and acceptable as human food.

Pounds or pens - are areas in the fish hold and on deck, divided off by stanchions and portable board structures for the storage of fish.

Bulk stowage - is the mass storage of fish in pounds on board the vessel.

Shelf stowage - is the storage of fish on board the vessel in single layers, on shelves.

Boxed stowage - is the storage of fish on board the vessel in boxes.

A suitable non-corrodible material - is impervious, free from pits, crevices and scale, is non-toxic and unaffected by sea water, ice, fish slime or any other corrosive material with which it is likely to come in contact. Its surface must be smooth and it must be capable of withstanding exposure to cleaning, including the use of detergents.

Potable water - is fresh water fit for human consumption. Standards of potability shall not be less than those contained in the "International Standards for Drinking Water", World Health Organization, 1963.

Sanitary sea water - used for food processing, should meet the same bacteriological standards as potable water.

Refrigerated sea water - is cooled by the addition of ice or by a suitable refrigeration system. Its salt content is normally about 3 percent.

Refrigerated brine - is a potable water and salt (sodium chloride) solution of about the same salinity as sea water. It is cooled in the same manner as refrigerated sea water.

Auction - is the first sale of the catch at a fishing port, by competitive buying. In most large fisheries this involves unloading and display of the catch.

A market - is an area or building used for the display and first sale of the catch.

General principles of fish spoilage

Soon after fish are dead, they begin to spoil, hence fresh caught fish pass through various stages of decay until they become putrid and unfit for human consumption.

Spoilage occurs for two main reasons: Firstly, the controlled biochemical processes (digestive enzymes) which occur in all living tissue to assist the digestion of food, continue after death in an uncontrolled manner. These digestive enzymes then begin to attack the surrounding flesh, causing it to become soft.

Secondly, bacteria are present on the gills, in the surface slime and in the intestines of live, healthy fish, but not in the flesh, which is sterile. Soon after death, bacteria on the skin, surface slime and intestines multiply rapidly and can soon be detected in the flesh near the skin and belly walls. The spread into the flesh can be much more rapid if the fish have been damaged in any way. The bacteria continue to multiply inside the flesh, and at the same time begin to break down the tissues into a series of compounds with strong odours and tastes, and thus the fish become putrid. In some species fat oxidation will also quickly occur and alter the flavour. The rate of chemical change and of bacterial activity depends on temperature. In general, the closer the temperature is to that of melting ice, 0°C (32°F), the slower the rate of chemical and bacteriological spoilage. For this reason, ice in one form or another is used throughout the world to prolong the storage life of fish.

Since bacteria from both intestines and surfaces with which the fish come in contact, play a major part in fish spoilage, high standards of cleanliness at all stages of handling, processing, storage and distribution are essential. This means that strict attention must be given to the efficient cleaning of the fish, the regular cleaning of all surfaces with which the fish come in contact, the provision of an uncontaminated water supply and the hygiene of workers. These factors are all important in order to provide the consumer with good quality wholesome food.

Chemical composition of fish flesh varies from species to species and even within species according to season, maturity, fishing ground, feed, etc. The rate of spoilage can therefore vary, and the spoilage pattern can be influenced by these factors.

HANDLING OF FRESH FISH AT SEA

General considerations

1. FISH ARE AN EXTREMELY PERISHABLE FOOD, AND SHOULD BE HANDLED AT ALL TIMES WITH GREAT CARE.

Fish quality deteriorates rapidly, and potential keeping time is shortened if they are not handled and stored properly. Much of the fish landed for human consumption is subjected to fairly rough handling treatment. Fish should not be exposed to direct sunlight or to the drying effect of winds, but should be carefully cleaned and cooled down to the temperature of melting ice, 0°C (32°F), as quickly as possible. Any careless treatment or delay in reducing the temperature of the fish will have a marked effect on their potential keeping time.

2. ALL FISH HANDLING, CONVEYING AND STORAGE EQUIPMENT, USED ON BOARD FISHING VESSELS, SHOULD BE DESIGNED FOR THE RAPID AND EFFICIENT HANDLING OF FISH, AND SHOULD BE SUITABLE FOR EASY CLEANING.

Much of the equipment currently used in the fishing industries is quite unsuitable for the purpose in which it is employed. More thought will require to be given to the design and layout of fixtures and plant used for the handling, conveying and storage of fresh fish.

Facilities and equipment

3. DECK POUND OR PEN STANCHIONS AND DIVIDING BOARDS SHOULD BE CONSTRUCTED OF SUITABLE NON-CORRODIBLE MATERIAL. THEY SHOULD BE ADEQUATE IN NUMBER AND HEIGHT TO PREVENT MOVEMENT OF THE FISH, DUE TO THE VESSEL'S MOTION.

In practice, wood is still used in many fisheries for deck pound boards and steel for stanchions and other fixtures. Where this is the case, the wood should be impregnated with rot-proof material and all surfaces should be smooth. Steelwork should be coated with anti-corrosive paint. Whenever possible, suitable non-corrodible materials should be used.

4. DECK POUND OR PEN DIVIDING BOARDS SHOULD BE FITTED TO ALLOW FOR EASY REMOVAL, AND SHOULD HAVE HAND GRIPS. BOARDS SHOULD HAVE GATES FITTED, AS REQUIRED, AND DRAIN NOTCHES CUT IN THE LOWER EDGES.

Gates are required to be fitted to the boards so that offal can easily be washed overboard. Drain notches allow water, slime and blood to flow away from fish lying in the pounds.

5. FISH WASHING AND CONVEYING EQUIPMENT SHOULD BE CONSTRUCTED OF SUITABLE NON-CORRODIBLE MATERIAL AND BE FITTED WITH CHUTES OR SIMILAR MEANS OF CONVEYING FISH INTO THE HOLD. CHUTES SHOULD BE OF SUFFICIENT LENGTH AND FITTED IN SUCH A MANNER THAT FISH DO NOT HAVE TO DROP MORE THAN 1 METRE (3 FT) INTO THE HOLD.

Washers should always be fitted with chutes or conveyors for efficient handling purposes and to prevent bruising or other damage to the fish, which often occurs when rough manual methods are used. Washers should be designed to give an adequate washing period, and should have a copious and continuous supply of sanitary sea water. The water should enter the washer through a number of jets, placed so that a water swirl is formed in the washer, allowing dirty water and scum to spill off and drain away.

6. ALL TUBS, TANKS, BARRELS AND OTHER CONTAINERS USED FOR HANDLING AND CONVEYING FISH SHOULD BE OF NON-CORRODIBLE MATERIAL AND EASY TO CLEAN.

In many areas wicker baskets are used for handling fish on deck. These are very difficult to clean properly, as small pieces of offal can cling to the framework. Containers with smooth hygienic surfaces are recommended for handling quantities of fish on deck.

7. DECK HOSES SHOULD BE SUPPLIED WITH SANITARY SEA WATER, AT ADEQUATE PRESSURE, BY A PUMP USED ONLY FOR SANITARY SEA WATER.

A good supply of sanitary sea water, at adequate pressure, should be available for washing fish and for flushing decks, holds, gear and other equipment in contact with the fish.

8. FISH HOLDS AND ANY PIPES AND CONDUITS PASSING THROUGH THE HOLD SHOULD BE ADEQUATELY INSULATED WITH SUITABLE MATERIAL.

Adequate insulation will reduce the amount of heat entering the fish hold and consequently the rate of ice meltage. If the quality and structure of the insulation is poor, excessive ice meltage will take place near bulkheads and shipside. This will allow fish temperatures to rise, and any fish which come in contact with the ship's structure may develop a particularly offensive smell.

9. FISH HOLD LININGS SHOULD BE COMPLETELY WATER-TIGHT.

It is most important to prevent water from carrying fish slime and blood to parts of the vessel where effective cleaning is virtually impossible. Water will also reduce the efficiency of the insulation and this will, in turn, lead to an increase in the temperature of the fish. The insulation should be covered with non-corrodible metal sheets, having water-tight joints to ensure protection from such contamination.

10. WOODEN FISH HOLDS SHOULD BE LINED WITH A SUITABLE MATERIAL.

The lining of wooden fishrooms should be similar to that described above or where this is not possible they should be sealed and coated with a suitable impervious and hygienic material which is easy to keep clean.

11. STANCHIONS SHOULD BE LOCATED IN THE FISH HOLD SO THAT THE BASE DIMENSIONS OF EACH POUND OR PEN DO NOT EXCEED 1.4 x 1.4 METRES (4.5 x 4.5 FT).

Larger pounds may permit the stowed mass of fish to move, due to the vessel's motion. They are less convenient for separating the fish by species and date of catching. Large pounds will require the use of more top ice during periods when fishing may be interrupted, before the pounds are completely filled.

12. PORTABLE BOARDS OF NON-CORRODIBLE MATERIAL OR IMPREGNATED AND PAINTED WOOD SHOULD BE USED FOR MAKING SHELVES AND VERTICAL DIVISIONS IN THE FISHROOM.

The use of portable boards, which are a good fit in the stanchions, allows the shelf and dividing structure to be dismantled and removed for cleaning.

13. SHELVING BOARDS SHOULD BE DESIGNED TO ALLOW ADEQUATE DRAINAGE.

A continuous trickle of melt water will help to carry away slime, blood and micro-organisms which should not be allowed to collect on the shelves. Corrugated boards in non-corrodible material are most suitable for this purpose.

14. THE SHELVES SHOULD BE INSTALLED SO THAT THE MAXIMUM DEPTH OF FISH, WHEN BULK STOWING, DOES NOT EXCEED 1 METRE (3 FT).

This is considered to be a maximum depth, and may be excessive for certain types of fragile fish. Experience has shown that the pressure caused by piling iced fish in greater depth results in weight losses and damage to the fish at the bottom of the pile. Where iced fish is stowed in pounds, shelves should be fitted at frequent intervals, to transfer the load to the hold structure and hull, without undue pressure on fish stowed below.

15. THERE SHOULD ALWAYS BE AMPLE DRAINAGE SPACE BETWEEN THE LOWEST SHELVES AND THE FLOOR OF THE FISH HOLD. THIS SPACE SHOULD BE OPEN TO A CENTRAL DRAIN, DISCHARGING DIRECTLY INTO ONE OR MORE SUMPS OR WELLS, LOCATED SO THAT THE HOLD CAN BE EFFICIENTLY DRAINED AT ALL TIMES. BILGE PUMP CONNECTIONS TO THESE SUMPS SHOULD BE FITTED WITH COARSE SCREEN FILTERS.

Proper drainage facilities are required to prevent a build-up of large quantities of melt water, blood and slime. If drainage is inadequate, the bottom fish in the hold will be contaminated by this dirty liquid, especially during any periods of severe motion of the vessel.

16. CONVEYORS USED IN THE FISH HOLD SHOULD BE MADE OF NON-CORRODIBLE MATERIAL AND SHOULD BE EASY TO DISMANTLE AND REMOVE FOR CLEANING PURPOSES.

Fish holds are difficult to clean thoroughly and board structures and any conveying equipment should be capable of easy removal, so that access can be gained to all parts of the hold.

17. WHERE BOXING AT SEA IS CARRIED OUT THE STANCHION AND DIVIDING STRUCTURE SHOULD BE DESIGNED TO ACCOMMODATE A NUMBER OF BOXES WITHOUT LEAVING LARGE AIR GAPS.

If the structure is not designed to suit the box dimensions, large gaps will be left where air can circulate, causing excessive ice meltage. Unless these spaces are filled with extra ice the fish temperature will rise.

18. EXCEPT FOR TANK STOWAGE IN REFRIGERATED SEA WATER OR REFRIGERATED BRINE, THE STOWAGE OF FISH FOR HUMAN CONSUMPTION IN HOLDS THAT ARE NOT DIVIDED INTO POUNDS IS NOT RECOMMENDED. THE HOLDS OF SMALL VESSELS CARRYING SUCH FISH AS HERRING SHOULD BE FITTED WITH AT LEAST ONE LONGITUDINAL AND ONE ATHWARTSHIP BULKHEAD, WHICH CAN BE REMOVED IF THE VESSEL CONVERTS TO OTHER TYPES OF FISHING. SUCH BULKHEADS SHOULD BE CONSTRUCTED OF SMOOTH, NON-ABSORBENT, EASILY CLEANED MATERIAL.

The fitting of removable type bulkheads increases the versatility of herring vessels and prevents movement of the stowed fish. They also permit rapid conversion to other types of fish stowage.

19. ICE USED IN EVERY FISHERY SHOULD BE MANUFACTURED FROM POTABLE WATER OR SANITARY SEA WATER.

Ice made from water which is neither potable or sanitary sea water may contaminate the fish with water-borne bacteria. These may be responsible for loss of keeping time and may also create a health hazard.

20. THE USE OF SANITARY SEA WATER ICE CANNOT BE GIVEN UNQUALIFIED RECOMMENDATION.

The use of sanitary sea water ice may be necessary in some areas, where there is a shortage of potable water, and there may also be some advantage in using sanitary sea water to manufacture ice at sea. The initial melting temperature of sanitary sea water ice may be as low as -5° to -6°C (23° to 21°F), but due to the leaching away of salt in the melt water, the melting temperature may rise again to nearly 0°C (32°F). Temperature, therefore, is variable. There is a risk that some of the fish stored in sanitary sea water ice will become partly frozen or too salty.

21. WHEN COOLING GRIDS ARE FITTED IN THE FISH HOLD THEY SHOULD BE PROPERLY INSTALLED AND OPERATED.

Where cooling grids are fitted in the fish hold, these can be used to prevent excessive ice meltage during the voyage to the fishing grounds. Grids may be valuable in cooling the fish hold and absorbing heat leak, especially in tropical waters. To be effective they should be fitted under the deck head and on the ship sides, and once fish has been stowed in the hold, control must be such that the hold temperature does not fall below 0°C (32°F). If it does, the top layers of ice may freeze into a solid crust, resulting in the top layers of fish being frozen slowly, on a long voyage, thus affecting their quality.

22. REFRIGERATED SANITARY SEA WATER OR REFRIGERATED BRINE MAY ALSO BE CONSIDERED FOR SOME FISHERIES.

The storage temperature achieved by refrigerated sanitary sea water or refrigerated brine makes it possible to chill large quantities of fish quickly, in tanks, and maintain the fish in a chilled condition. Fish are chilled more rapidly by this immersion process than when iced, and if stowed at the correct density are in close contact with the cooling medium at all times.

This type of stowage has been found successful where very large quantities of small fish are caught in each haul and where it would be difficult to stow the catch quickly in ice. It has as yet only proved successful for very short voyages. A storage time of more than a few days can affect the appearance of certain species, and the scouring effect of fish rubbing together in a tank of water can also remove the scales from some species.

There is as yet insufficient evidence to recommend refrigerated sea water or refrigerated brine for anything but very short term storage, but experience has shown that for some species, notably Pacific halibut, Pacific salmon and tuna, it is a good method of preservation at sea.

23. WHERE SEA WATER OR BRINE STOWAGE TANKS ARE COOLED BY THE ADDITION OF ICE, SALT CONCENTRATION SHOULD BE MAINTAINED AT ABOUT 3 PERCENT.

In practice this can be achieved by the addition of salt, the quantity being regulated by the amount of ice used. If the sea water or brine is too dilute, the fish can absorb water and hence quality can suffer.

24. WHERE SANITARY SEA WATER OR BRINE AND ICE MIXTURES ARE USED FOR COOLING AND STORING THE CATCH, THERE SHOULD BE ADEQUATE CIRCULATION OF THE LIQUID.

Some means of circulating the cold liquid round the mass of fish should be provided. If pumping facilities are inadequate some of the load may not be cooled properly, resulting in fish with highly unpleasant odours and flavours.

25. REFRIGERATED SEA WATER OR REFRIGERATED BRINE SYSTEMS SHOULD BE PROPERLY DESIGNED TO GIVE ADEQUATE COOLING CAPACITY.

The cooling capacity must be related to catching rates in the fishery involved. The system should be designed by refrigeration experts having a knowledge of the fishery, including catching and stowage rates, fish, water and ambient temperatures. The system must be capable of rapidly chilling large volumes of fish.

26. IN ALL SHIPS USING REFRIGERATED SEA WATER OR REFRIGERATED BRINE SYSTEMS FOR PRESERVATION OF THE CATCH, TANKS, HEAT EXCHANGERS, PUMPS AND ASSOCIATED PIPING SHOULD BE MADE OF, OR COATED WITH, SUITABLE NON-CORRODIBLE MATERIAL. THEY SHOULD BE DESIGNED SO THAT THEY CAN EASILY BE CLEANED AND PROTECTED FROM DETERIORATION.

With hard, non-porous surfaces such as aluminium-alloy or plastics, spoilage bacteria deposited during storage of the fish can be easily removed, thus reducing the risk of contaminating later catches. It is important to avoid corners and edges in which filth can lodge.

27. REFRIGERATED SEA WATER OR REFRIGERATED BRINE TANKS SHOULD BE INSULATED TO MINIMIZE HEAT LEAKAGE FROM THEIR SURROUNDINGS.

The temperature of the refrigerated sea water will be more uniform throughout the tank and more easily controlled if the heat leak from other sources is reduced by effective insulation.

28. THE REFRIGERATION PLANT AND SEA WATER OR BRINE CIRCULATING EQUIPMENT SHOULD BE ADEQUATE TO MAINTAIN THE TEMPERATURE OF THE FISH AT -1°C (30°F).

At this temperature spoilage is delayed. If the temperature is reduced below -1°C (30°F) the fish may be damaged because of partial freezing. In practice it is extremely difficult to control the temperature so precisely, but a range of -1° to $+2^{\circ}\text{C}$ (30° to 34°F) is achievable.

29. HOLDS THAT ARE NOT DIVIDED INTO POUNDS OR PENS SHOULD HAVE AN ADEQUATE NUMBER OF DRAIN LINES LOCATED AT INTERVALS ALONG THE HOLD, DISCHARGING TO A CENTRAL DRAIN OR BILGE. VERTICAL DRAIN SLOTS SHOULD BE LOCATED ALONG BOTH THE FORWARD AND AFT BULKHEADS, RUNNING FROM DECKHEAD TO BILGE.

As has already been stated, holds which are not divided into pounds are not to be recommended. Those which do exist in very small vessels also require adequate drainage facilities.

In a hold containing tanks, floor gutters should be installed, draining from all areas of the hold to a bilge sump. Fish hold bilge sumps should have separate piping and valves so that fish juices and slime do not flow into the other bilge lines.

Sanitary requirements

30. SEA WATER WHICH HAS BEEN USED FOR COOLING ENGINES, CONDENSERS OR SIMILAR EQUIPMENT SHOULD NOT BE USED FOR WASHING FISH, DECK, HOLD, OR ANY EQUIPMENT IN CONTACT WITH FISH.

The water used for cooling engines and other machinery will be at a higher temperature than the sea water, and may be contaminated with oil. This water will therefore accelerate the spoilage of the fish.

31. WHEN CLEANING AND HOSING OPERATIONS ARE CARRIED OUT WHILE THE VESSEL IS IN PORT, POTABLE WATER OR SANITARY SEA WATER SHOULD BE USED.

The water should always be free from objectionable contamination, the total number of bacteria in it should be low, and it ought not to contain any pathogenic micro-organisms. Contamination of the fish by water-borne bacteria and other undesirable substances may cause quick loss of quality and become a health hazard. Harbour water is usually heavily contaminated, and should never be used for cleaning purposes. This is also true for water in the close vicinity of factories, processing plants and factory ships.

32. DECKS, BOARDS, STANCHIONS AND ALL OTHER DECK EQUIPMENT WHICH WILL COME IN CONTACT WITH FISH SHOULD BE HOSED DOWN WITH SANITARY SEA WATER AND BRUSHED TO REMOVE ALL VISIBLE DIRT, SLIME AND BLOOD BEFORE ANY FISH COMES ABOARD, AND BETWEEN EACH HAUL OF THE GEAR.

The purpose of this washing is to remove all traces of slime, blood, tar, oil or other contaminating matter which may cause discolouration and offensive odours in the fish. In most fisheries this cleaning can be carried out while the net is in the water.

33. ALL TUBS, TANKS, BARRELS, BASKETS AND OTHER EQUIPMENT USED IN THE HANDLING, GUTTING, WASHING AND CONVEYING OPERATIONS SHOULD BE THOROUGHLY CLEANED AFTER EACH CYCLE OF OPERATIONS.

Any filth, slime or blood allowed to dry and accumulate on fish container surfaces will be very difficult to remove properly, and will thus contaminate the catch.

34. THERE SHOULD BE NO SHARP CORNERS OR PROJECTIONS IN THE HOLD, AS THESE WILL MAKE CLEANING DIFFICULT.

Contamination with fish slime and blood will build up rapidly on surfaces, in corners or around projections which are not smooth and impervious.

35. DURING FISHING TRIPS THE FISH HOLD BILGE SUMP SHOULD BE DRAINED REGULARLY. THE SUMP SHOULD BE ACCESSIBLE AT ALL TIMES.

Bilge water containing blood and slime, if not regularly pumped out, will assist bacterial activity and give rise to offensive odours in the fish hold.

36. COD ENDS AND OTHER PARTS OF THE FISHING GEAR WHICH COME IN CONTACT WITH FISH SHOULD BE FREED OF DEAD FISH AFTER EACH HAUL. ALL GEAR SHOULD BE THOROUGHLY CLEANED WHEN FISHING HAS CEASED.

Dead fish left in the nets will decompose and contaminate later catches.

37. IMMEDIATELY THE CATCH IS UNLOADED, THE DECK AND ALL DECK EQUIPMENT SHOULD BE HOSED DOWN, BRUSHED, THOROUGHLY CLEANED WITH A SUITABLE CLEANING AGENT, DISINFECTED AND RINSED.

Fish blood, guts, slime and dead fish left on the deck will support bacterial growth which may contaminate future catches. If allowed to dry, the slime and blood are very difficult to remove.

38. IMMEDIATELY THE CATCH IS UNLOADED, THE FISH HOLD AND BILGE SUMP SHOULD BE EMPTIED COMPLETELY. ALL SURFACES IN THE HOLD, POUND BOARDS AND SUMP SHOULD BE THOROUGHLY CLEANED WITH A SUITABLE CLEANING AGENT, DISINFECTED AND RINSED.

This is necessary to remove all fish slime, blood and other residue as soon as the catch is landed, in order to avoid bacterial growth, offensive odours and the drying of residues on the hold surfaces. Cleaning should be completed before ice is taken on board for the next trip.

39. IN SHIPS USING REFRIGERATED SEA WATER OR REFRIGERATED BRINE SYSTEMS FOR THE PRESERVATION OF THE CATCH, ALL TANKS, PUMPS, HEAT EXCHANGERS AND OTHER ASSOCIATED EQUIPMENT SHOULD BE CLEANED IMMEDIATELY AFTER DISCHARGING THE CATCH. POTABLE WATER CONTAINING A SUITABLE CLEANING AGENT SHOULD BE CIRCULATED THROUGH ALL PARTS OF THE SYSTEM. TANKS SHOULD BE INSPECTED CAREFULLY AND CLEANED OUT BY BRUSHING IF NECESSARY.

Since anearobic bacteria are particularly active under tank storage conditions, a very high standard of sanitation is required to avoid their build up and the spread of infection from one tank to another.

40. WHEN A VESSEL CONVERTS TO STORING FISH IN ICE FOR HUMAN CONSUMPTION, AFTER CATCHING SPECIES SUCH AS HERRING FOR REDUCTION PURPOSES, THE HOLD MUST BE THOROUGHLY CLEANED, DISINFECTED AND RINSED.

Cleaning should be carried out with high pressure potable water containing a suitable cleaning agent, followed by a thorough rinsing. A suitable disinfectant should then be applied to all surfaces and remain in contact long enough to complete the disinfection. Always, when using proprietary products, the manufacturer's recommendations as to the concentration and treatment time should be followed. Finally the hold should be thoroughly rinsed with potable water.

Handling the catch on board

41. HANDLING THE CATCH SHOULD BEGIN AS SOON AS IT COMES ON BOARD.

In those fisheries where sorting is done immediately the fish are taken on board, it should be carried out quickly, to avoid any risk of damage due to abrasion, particularly where the catch contains spiny and rough-skinned species. Fish unsuitable for human food because of small size, spoilage, damage, parasitization, poisonous nature or any other reason should also be quickly removed from the catch.

42. WHERE IT IS REQUIRED TO KEEP SPECIES UNSUITABLE FOR HUMAN FOOD, THESE SHOULD ALWAYS BE SORTED FROM THE EDIBLE CATCH AND KEPT SEPARATE AT ALL TIMES.

If fish, unsuitable for human food, are brought back to port as, for example, for fish meal manufacture, care should be taken to avoid contamination of the edible catch increasing spoilage risk.

43. FISH SHOULD NOT BE STOOD UPON, AND SHOULD NOT BE PILED DEEPLY ON DECK.

Physical damage, whether by crushing, bruising, rubbing or scraping assists spoilage and reduces the value of the fish for subsequent food processing purposes.

44. ALL FISH ON DECK SHOULD BE PROTECTED FROM SUN, FROST, AND THE DRYING EFFECTS OF WIND.

In warm climates it is essential to prevent the fish temperatures from rising. Each degree of rise in temperature increases the rate of spoilage. If the catch is to be on deck for any length of time, it should be protected by an awning, ice, or even a wet canvas or burlap. Drying may lower market value by spoiling the appearance and possibly inducing rancidity. Slow freezing of the catch on deck, in areas where very low temperatures are encountered, should also be avoided.

45. LINE CAUGHT FISH SHOULD, WHEREVER PRACTICABLE, BE STUNNED AS SOON AS THEY ARE TAKEN ON BOARD THE VESSEL.

If fish are allowed to struggle and thrash about on deck, they may not only be badly bruised, but may become exhausted before they die, and their quality thereby impaired. It is of course recognized that the stunning of small fish is impracticable.

46. GUTTING SHOULD COMMENCE AS SOON AS THE CATCH COMES ON DECK.

The reasons for prompt gutting are, firstly, to sever some of the main blood vessels allowing the fish to bleed and, secondly, to remove the stomach and gut which would otherwise cause a softening of the flesh and accelerate spoilage. Fish in which the guts are full of food will spoil even more rapidly. Although rapid gutting is desirable with most species, particularly in tropical climates, the catch in certain fisheries cannot be handled rapidly enough, and advantages gained by gutting may be offset by quality loss resulting from rises in fish temperature. In such circumstances it would be preferable to get the fish under cover and chilled quickly, rather than delay the chilling operation by gutting.

47. WHERE RAPID GUTTING IS NOT PRACTICABLE WHOLE FISH SHOULD BE WASHED AS SOON AS IT COMES ON DECK.

This helps to remove filth, particularly gut contents squeezed out of the fish in the net, and it helps to prevent excessive contamination during subsequent gutting and handling.

48. IT IS USUALLY IMPRACTICABLE TO GUT VERY SMALL FISH. THESE SHOULD THEREFORE BE PLACED IN CHILLED STORAGE QUICKLY.

Any delay in chilling very small whole fish will have an adverse effect on their quality. Failure to stow these fish quickly may expose them to the effect of weather as well as to physical damage.

49. GUTTING SHOULD BE COMPLETE AND CARRIED OUT WITH CARE.

Pieces of gut or liver, if not completely removed, will act as centres from which spoilage will develop. Enzymes from pieces of gut and liver will digest the flesh and facilitate the entry of bacteria. Careless gutting, for example, cutting beyond the vent of a fish will also allow the entry of bacteria into the flesh. Nevertheless, cuts should be adequate to allow easy access to the belly cavity and complete removal of guts.

50. FISH GUTS SHOULD NOT BE ALLOWED TO CONTAMINATE OTHER FISH ON DECK.

Fish guts contain digestive enzymes and spoilage bacteria. If allowed to foul the rest of the catch, the spoilage rate will be increased. This contamination can be prevented by dropping guts into suitable containers or chutes discharging over the ship side.

51. FISH SHOULD BE WASHED WITH SANITARY SEA WATER.

Immediately after gutting, fish should be thoroughly washed with sanitary sea water to remove all blood, slime and pieces of gut. Fish blood coagulates rapidly and washing will facilitate more complete bleeding, which in turn will improve the appearance of the product. The practice, common in some inshore fisheries, to gut and wash the fish close to land involves the risk of using polluted sea water, and should therefore be discouraged.

Harbour water, which is always polluted in some way, should never be used for washing fish.

52. ON COMPLETION OF WASHING THE FISH, ANY FURTHER HANDLING SHOULD BE CARRIED OUT WITHOUT DELAY.

Any delay in handling the washed fish before it is chilled, reduces the potential keeping time. In warm climates a delay of one hour can have a serious effect on the quality of the final product.

53. DECK HATCHES SHOULD NOT BE LEFT OPEN LONGER THAN NECESSARY TO LOAD THE FISH.

Only one fishroom hatch should be opened to allow the loading of fish and to prevent undue heat leak into the hold. Where two or more hatches are open at the same time, a current of warm air may flow through the fishroom, causing undue ice meltage.

54. FISH SHOULD BE ALLOWED TO SLIDE DOWN CHUTES INTO THE HOLD OR BE LOWERED IN SUITABLE CONTAINERS.

Fish can be damaged and their market value reduced if they are thrown or dropped into the hold.

55. FISH SHOULD BE CHILLED RAPIDLY IN MELTING ICE AND SHOULD BE STORED SO THAT THE TEMPERATURE DOES NOT RISE. FOR SHORT TERM STORAGE, REFRIGERATED SEA WATER OR REFRIGERATED BRINE MAY BE USED.

It is well known that temperature is the most important single factor influencing the keeping quality of fish. It has been shown that cod spoils about $5\frac{1}{2}$ times as fast at 10°C (50°F), and about $2\frac{1}{2}$ times as fast at 4.4°C (40°F), as it does at 0°C (32°F). Expressing this in another way, cod that would remain edible for about 14 days stored at 0°C (32°F) would be edible for only 6 days if stored at 4.4°C (40°F) and for less than 3 days if stored at 10°C (50°F). It is also known that the effects of increasing temperature are cumulative; that is, some potential keeping time is lost each time the temperature of the fish is allowed to rise. The extent of this loss depends both on the amount of temperature rise and the length of time it remains at the higher temperature. It is therefore most important to quickly chill the fish to the temperature of melting ice, soon after capture, and maintain it in a chilled condition until it reaches the consumer. In some areas refrigerated sea water or refrigerated brine is used for chilling and storing the fish. Here again the chilling should be rapid and the system capable of maintaining the fish at 0°C (32°F).

56. FISH IN ICE SHOULD BE STOWED IN SHALLOW LAYERS.

The best bulk stowage is the shallowest, with the fish well mixed with finely divided ice. It is appreciated that in some fisheries a compromise is necessary, because it is rarely possible to stow all the catch in very shallow layers, a few fish deep, between shelves. It is perhaps not sufficiently widely recognized that fish at the bottom of a deep pile can lose considerable weight. It has been observed, for instance, that haddock at the bottom of a pound 1 metre (3 ft) deep can lose as much as 15 percent of its initial gutted weight after about two weeks' storage.

57. THE PRACTICE OF SHELF STOWAGE IS NOT TO BE RECOMMENDED, UNLESS THE SINGLE LAYERS OF FISH ARE COMPLETELY COVERED WITH LAYERS OF ICE.

In practice, shelf stowage involves the laying out of single layers of fish side by side and head to tail, belly down on a bed of ice, but with no ice among or on top of the fish. Single fish laid out in this manner are only cooled from one side, and therefore cool down less rapidly than fish well mixed with ice. The backs and heads of the fish can remain quite warm throughout the storage period, and bacteria originating in the gills can spread rapidly along the backbone. It has been found that these shelf stowed fish are inferior in quality compared with fish which have been shallow bulk stowed at the same time.

Where fish are shelf stowed, ice should always be added, around and on top of each layer.

58. FISH SHOULD BE SURROUNDED BY ADEQUATE QUANTITIES OF ICE.

Sufficient quantities of ice are necessary, not only to cool the fish, but to maintain it in a cool condition. There should be enough ice to cope with any heat leaking into the fish room and the ice should be properly distributed. If, at the end of a voyage, fish are no longer completely surrounded by ice, then insufficient has been used. It is difficult to lay down precise quantities required, but icing should be heaviest against shipsides and bulkheads, since the heat leak into the hold will depend on its construction, the temperature of the surrounding sea and areas of the vessel adjacent to the fish hold. In warm waters it will be necessary to use greater proportions of ice than in colder climates, and the quantity will also depend on whether the hold is insulated. It must be emphasized that the correct quantities of ice require to be worked out for individual vessels by trial and error. In the final analysis the best way to determine correct ice quantities is to measure the temperature of the fish from time to time. In many countries fishery research organizations are available to give advice on how to measure these temperatures.

Stowage of fish in ice is generally practiced on fishing vessels making trips of a few days or more, but many small inshore vessels do not use ice or any other form of preservation, and consequently there is often considerable and unnecessary loss of fish quality.

59. ICE SHOULD ALSO BE USED TO PREVENT CONTACT WITH ALL SURFACES IN THE FISH HOLD.

It is good practice to prevent fish from coming in contact with shipsides, bulkheads and all fishroom structures. If fish are pressed against those surfaces, or even against one another, so that air is excluded, a peculiarly offensive type of bacterial spoilage takes place, and fish which otherwise appear to be in good condition are rendered quite inedible, because of the development of foul odours and flavours. Inadequate icing may result in fish coming in contact with these surfaces.

60. FINELY DIVIDED ICE SHOULD ALWAYS BE USED TO GIVE CLOSE CONTACT WITH THE FISH.

To maintain close contact with the fish at all times, ice used for chilling and preservation should always be finely divided in one form or another. Any large lumps of ice can cause damage to fish, and will not be effective, because they make poor surface contact with the fish. Various forms of ice are used in many fisheries, the important factor is that they should all consist of finely divided particles.

61. WHERE BOXED STOWAGE IS USED, THE FISH SHOULD BE PROPERLY ICED AND THE BOXES NOT OVERFILLED.

The packing of fish, together with ice, into containers at sea, termed "boxing at sea" in some areas, offers a number of advantages for certain fisheries. When properly iced the fish can remain undisturbed in the boxes until they reach the processor. Unloading the catch can become a simpler operation, and more ice can be added to the boxes on landing, without disturbing the fish.

Generally, properly boxed iced fish should be of a higher quality than fish caught the same day and stored in other ways. Each day's catch can also be separated more easily. Since boxes are stacked one on another, in the fish hold, overfilling will cause crushing and damage to the fish. For efficient cooling, each box should contain a layer of ice on the bottom, then some fish and ice mixed together, and lastly a top layer of ice.

62. FISH SHOULD NOT BE PACKED IN REFRIGERATED SEA WATER OR REFRIGERATED BRINE TO A DENSITY OF MORE THAN 800 KG PER CUBIC METRE (50 LB PER CUBIC FOOT).

If too much fish is loaded into the tank there will not be sufficient space for the circulation of adequate sea water throughout the load, and some fish will not be cooled properly. This practice will also add an extra load on the refrigeration equipment in which case the desired temperature conditions may not be reached. The density of fish given above is an upper limit and may be high for certain species.

63. A STOWAGE PLAN SHOULD BE KEPT ON ANY VESSELS FISHING FOR MORE THAN A DAY OR TWO.

A well prepared stowage plan enables the various days' catches to be kept separate when unloading. Fish from different days' catches should never be stored mixed together.

64. AT THE CONCLUSION OF EACH FISHING TRIP, ALL UNUSED ICE SHOULD BE REMOVED FROM THE FISHROOM BEFORE CLEANING BEGINS.

Ice left in the fishroom, even if it has not been used on the previous trip, may be contaminated with fish spoilage bacteria. If this ice is used on any subsequent trips, for cooling fish, it may accelerate spoilage of the catch.

Unloading the catch

65. UNLOADING THE CATCH SHOULD BE CARRIED OUT IN A CAREFUL MANNER, BUT WITH LITTLE DELAY.

In most fisheries the catch is landed after being separated from the ice in the fishroom. Any undue delay at this stage allows the fish temperature to rise, thus increasing the rate of spoilage. For this reason, the landing of boxed iced fish is to be recommended.

66. MIXING OF DIFFERENT DAYS' CATCHES DURING UNLOADING SHOULD BE AVOIDED.

Batches of fish, of mixed quality, may often fetch a lower price on the market. Poorer quality fish will soon contaminate any of higher quality if they are mixed together. A good stowage plan, showing the position of each day's catch in the hold may avoid mixing.

67. FISH SHOULD NOT BE DAMAGED DURING UNLOADING.

The use of hooks, shovels, forks and other such implements should be avoided, in order that the fish suffer no damage. Where these implements are used they should be handled with great care. Tearing of the flesh reduces the value of the fish and accelerates spoilage.

68. MECHANICAL UNLOADING EQUIPMENT SHOULD BE USED WHERE POSSIBLE.

Properly designed systems employing mechanical conveyors, fish pumps or other such equipment can increase the unloading rate and cause less damage than the traditional manual methods. With faster unloading, the time that the fish are exposed to the outside environment may be decreased, thus delaying spoilage. Some effective fish pumps are available for large and small fish and should only be used with potable water or sanitary sea water. They are not yet suitable for handling all species.

69. THE CATCH SHOULD BE UNLOADED INTO CLEAN CONTAINERS AND IMMEDIATELY PLACED IN A SUITABLY COVERED AREA. WHILE LYING IN THIS AREA THE CATCH SHOULD BE MAINTAINED IN A CHILLED CONDITION.

No fish should be allowed to lie on floors or other unclean surfaces and they should not be exposed to direct sunlight. The use of clean containers and a supply of ice will increase keeping time.

70. CARE SHOULD BE TAKEN THAT FISH ARE NOT DAMAGED OR CONTAMINATED DURING SORTING, WEIGHING AND TRANSFER TO CONTAINERS.

Physical damage can increase spoilage rate and badly torn fish are useless for processing purposes.

HANDLING OF FRESH FISH ON SHORE

General considerations

71. FRESH FISH SHOULD BE HANDLED, PROCESSED AND DISTRIBUTED WITH CARE AND A MINIMUM OF DELAY.

Poor handling of fish on shore can ruin the best efforts of the fisherman. As has already been explained, even well iced fish loses quality in a relatively short time. If unnecessary delays occur after the fish are landed, keeping time can be reduced considerably. Everyone concerned should therefore exercise the greatest care and at the same time endeavour not to delay each stage in the handling and distribution chain.

Fresh fish is often handled a number of times after it is landed, and the effects of bruising, contamination or exposure to unduly high temperatures will become apparent by the time the final product reaches the consumer. Fresh fish have a very short time in which to remain in a marketable condition and no unnecessary delays should occur in the processing and distribution channel.

The precise steps which follow unloading of the fish from the vessel vary from one fishery to another. In some areas the catch may be unloaded and transported directly to a large processing factory, in others it may be laid out in containers in a market and sold by auction. Sales may also be made through intermediates before the fish reaches the processor.

Whatever the system, it is essential to ensure that the fish reaches the consumer in an acceptable condition.

72. FRESH FISH SHOULD ALWAYS BE TREATED IN A SANITARY AND HYGIENIC MANNER.

All equipment, facilities, operations and personnel should meet with the general principles of food hygiene as set out in Appendix 1.

Facilities and equipment

73. MARKET CONTAINERS SHOULD BE MADE OF A SUITABLE NON-CORRODIBLE MATERIAL AND SHOULD BE CONSTRUCTED SO THAT THEY CAN BE EASILY CLEANED.

The type of container used in fish markets varies from area to area, but whatever shape or dimensions, they should not have crevices, lips or sills which render them difficult to clean. Containers of wood and wicker cannot be cleaned satisfactorily and their use should be discouraged. A number of plastic and light alloy containers are now available for the handling and storage of fish.

74. CONTAINERS SHOULD BE LARGE ENOUGH TO HOLD ADEQUATE QUANTITIES OF ICE AS WELL AS THE CORRECT WEIGHT OF FISH. THEY SHOULD BE STRONG ENOUGH TO WITHSTAND FAIRLY ROUGH HANDLING AND BE SUITABLE FOR STACKING WHEN FILLED, WITHOUT DAMAGE TO FISH IN BOXES BELOW. DRAINAGE SHOULD ALSO BE ARRANGED TO AVOID CONTAMINATION OF FISH IN STACKED BOXES.

As the fish should always be well iced, it is desirable that the containers be large enough to hold adequate quantities of ice for the standard amount of fish being sold. It should be possible to stack containers close together to reduce the amount of heat absorbed from the surrounding atmosphere. Good drainage arrangements prevent fish lying in bacteria-laden melt-water.

75. RETURNABLE BOXES SHOULD BE OF SUITABLE NON-CORRODIBLE MATERIAL

Returnable boxes should be clean to avoid contamination, and strong enough to withstand physical damage to the fish during transit. The boxes should also be large enough to hold sufficient ice in order to maintain the fish in a chilled condition while being transported. Boxes of plastic or light-alloy material are recommended, as wood cannot be cleaned properly.

New developments in some areas include the use of plastic non-returnable liners and returnable outer boxes in alloy material. Some have built-in melt-water compartments so that they can be transported along with other goods, which might otherwise be contaminated by the melt-water.

76. NON-RETURNABLE BOXES SHOULD BE STRONGLY CONSTRUCTED AND DURABLE ENOUGH FOR ANY HANDLING OPERATION DURING DISTRIBUTION. THEY SHOULD BE LARGE ENOUGH TO HOLD AN ADEQUATE AMOUNT OF ICE AS WELL AS THE REQUIRED WEIGHT OF FISH. PROVISION SHOULD BE MADE FOR THE DRAINAGE OF MELT-WATER. WHERE WOOD IS USED IT SHOULD BE CLEAN AND NEW.

Non-returnable boxes, in a variety of materials, are used in various fisheries. Many are of poor construction and are easily broken during distribution, thus damaging the contents, or allowing outside contamination to take place. In some cases boxes are too small to hold adequate quantities of ice. Overfilling a box will result in the crushing and bruising of fish when the boxes are stacked for transport. In many areas, non-returnable boxes are now available constructed of specially treated fibre-board. Others are made from expanded plastic material which acts as an insulant as well as a container but the fish must of course be chilled before packing, or the insulation would maintain them at a higher temperature.

77. FISH PROCESSING PLANTS SHOULD BE SPECIALLY DESIGNED FOR THE PURPOSE.

Fish processing plants demand special facilities and materials which in some cases are unique. Some recommendations are given in Appendix II.

78. OPERATIONS SHOULD BE CARRIED OUT IN A MANNER AND CONDITIONS SUITABLE FOR THE HANDLING OF FOOD FOR HUMAN CONSUMPTION.

Various specific recommendations are given in this code but each type of operation has detailed requirements, which cannot be discussed here. For example, the disposal of fish waste material can often be a serious problem, but this has been solved in some fisheries where plant is available to process it into meal. Nevertheless, solutions are not necessarily universally applicable and must be interpreted according to local requirements. Such unique operational problems deserve more comment than is possible here, and a detailed document on these aspects will be published in the future. At present, operators should consult their national or regional fishery organizations, or FAO, regarding any problems on plant and facilities.

79. ADEQUATE FACILITIES SHOULD BE AVAILABLE, AT THE PROCESSING PLANT, TO MAINTAIN FISH IN A CHILLED CONDITION.

Where supplies of fish cannot be processed on arrival at the factory, and for the storage of the final product where this cannot be distributed soon after packing, adequate facilities are required to keep the fish cool. It must be noted, however, that where chill rooms are installed, these are not designed to cool the fish but only to maintain them in this condition once they have been cooled by ice or other means.

80. FILLETING BOARDS AND OTHER SURFACES ON WHICH FISH ARE CUT SHOULD BE MADE OF IMPERVIOUS MATERIALS WHICH MEET THE PHYSICAL REQUIREMENTS FOR CUTTING SURFACES.

A lot of bacterial contamination of fillets and steaks is caused by contact with the filleting and cutting boards. Wooden cutting surfaces quickly become porous and water-logged and are practically impossible to clean thoroughly. They are not recommended as suitable for this type of work, unless they are hardwood.

81. THE USE OF PROPERLY DESIGNED MACHINES FOR FILLETING, SKINNING, STEAKING AND SIMILAR OPERATIONS IS TO BE ENCOURAGED.

Properly designed machines will simplify the production of fillets and similar products in quantity, with consistently low bacterial counts. This is mainly because well designed machines have impervious and non-corrodible working surfaces and are easy to clean.

82. ALL FILLETTERS SHOULD BE TRAINED AND REQUIRED TO USE FILLETING TECHNIQUES IN WHICH CONTACT BETWEEN THE CUT SURFACES OF THE FILLET AND THE FILLETING BOARD IS MINIMIZED.

The more skilled the filleter, the quicker the fish are filleted, with less risk of contamination from cutting surfaces.

Sanitary requirements

83. ALL WHARVES, QUAYS, MARKETS AND SIMILAR AREAS WHERE FISH ARE UNLOADED AND DISPLAYED FOR SALE, SHOULD BE KEPT CLEAN AND DISINFECTED.

Fish, as a food for human consumption should be treated as such, in clean surroundings. Any dirty surfaces in the vicinity of the unloading area involves the risk that fish will be contaminated with filth and pathogenic organisms.

84. MARKET CONTAINERS AND ALL RETURNABLE FISH BOXES SHOULD BE THOROUGHLY CLEANED AND TREATED WITH DISINFECTANT DIRECTLY AFTER EACH USE.

The use of properly designed washing machines is recommended wherever practicable. Good washing by hand can be achieved by scrubbing with stiff brushes and by using high pressure water jets, with detergent added to the water. A preliminary rinse in potable cold water, followed by a wash with hot water at a minimum temperature of 43°C (110°F) has been recommended for efficient cleaning. An ample supply of potable water at adequate pressure is the first requirement and cleaning will be much easier if slime and blood are not allowed to dry on to the container surfaces.

85. ALL HANDLING AND PROCESSING OPERATIONS INVOLVED IN THE PREPARATION AND DISTRIBUTION OF FILLETS AND SIMILAR PRODUCTS SHOULD BE CARRIED OUT UNDER SANITARY AND HYGIENIC CONDITIONS.

This is often the last processing stage before the product reaches the consumer. Fillets and similar products are particularly vulnerable to contamination, as their preparation usually involves much handling. When the flesh is exposed, any contamination with bacteria will rapidly reduce potential keeping time. All plant, equipment and fish workers should therefore comply with the general principles of food hygiene as set out in Appendix 1.

86. FILLETING AND CUTTING BOARDS SHOULD BE THOROUGHLY SCRUBBED AND FREQUENTLY TREATED WITH DISINFECTANT. WHEREVER PRACTICABLE THE BOARDS SHOULD BE CONTINUOUSLY FLUSHED WITH CLEAN RUNNING WATER DURING USE. THE FLUSHING WATER SHOULD CONTAIN 4 ppm OF RESIDUAL CHLORINE.

It is recognised that the amount of bacterial contamination on fillets and similar products is related to the amount of bacterial contamination of the working surfaces. Clean surfaces become contaminated as soon as they are used, and consequently each fish that is filleted, after the first one, increases the surface contamination. Filleting and cutting surfaces should therefore be cleaned frequently. If they are not thoroughly scrubbed and disinfected at the end of each working day there may be a serious day-to-day carry-over of bacterial contamination.

It has been proved that this contamination of both fillets and boards can be considerably reduced by continuous flushing with clean water. A further reduction in contamination has been observed when using chlorinated water for flushing.

87. CANDLING TABLES SHOULD BE EASY TO CLEAN AND THEY SHOULD NOT RAISE THE TEMPERATURE OF THE FILLETS.

Since heat from the light may produce rapid growth and activity of bacteria on candling surfaces, these should be thoroughly cleaned and treated with disinfectant at frequent intervals. For this reason a cold light source may be preferable.

88. DIP TANKS USED IN FILLET PRODUCTION SHOULD BE MADE OF IMPERVIOUS NON-CORRODIBLE MATERIALS AND SHOULD BE EASY TO CLEAN. DIP TANKS SHOULD BE EMPTIED, THOROUGHLY CLEANED AND DISINFECTED BETWEEN EACH CYCLE OF USE.

Where it is desired and permissible to use such dips as anti-oxidants or polyphosphates, the dangers of contamination must be fully appreciated. Bacterial numbers will increase rapidly during use, and this requires that the tanks be thoroughly cleaned and new solutions used frequently.

89. ALL MACHINES USED FOR FILLETING, SKINNING, STEAKING OR SIMILAR OPERATIONS SHOULD BE THOROUGHLY CLEANED AND DISINFECTED AT LEAST ONCE A DAY.

The use of machinery reduces the risk of contamination from human sources. If, however, these machines are not properly maintained and cleaned at least once every day, they can become a serious source of contamination

90. ONLY NEW AND CLEAN BOXES, CARTONS AND WRAPPING MATERIAL SHOULD BE USED FOR THE TRANSPORT AND DISTRIBUTION OF FILLETS AND SIMILAR PRODUCTS. WHERE RETURNABLE BOXES ARE STILL USED THEY SHOULD BE OF NON-CORRODIBLE MATERIAL AND THOROUGHLY CLEANED AND DISINFECTED AFTER USE.

The practice of using returnable boxes for the transport and distribution of fillets and similar products should be discouraged, unless the box is constructed of light inner non-returnable container protected by a stronger returnable outer case.

All too often, returnable boxes lie around processing plant yards in an unwashed, filthy condition, where blood and slime are allowed to dry on to the box surfaces. They are then found to be extremely difficult to clean properly and may only receive a quick hose down with cold water.

As the importance of protecting fillets and other similar products from all sources of contamination cannot be overemphasized, new and clean non-returnable containers should always be used.

Handling of whole and gutted fish after unloading

91. FISH SHOULD NOT BE DISPLAYED OR LEFT LYING ABOUT MARKETS OR AUCTION HALLS ANY LONGER THAN NECESSARY TO MEET INSPECTION REQUIREMENTS AND SALE.

The auction system of selling fish offers some economic advantages, but where the auction requires the laying out of unchilled fish, the practice is technologically undesirable. The fish should always be mixed with suitable quantities of ice. In areas where only one auction takes place in a day, the sale may be delayed for a number of reasons, increasing the rate of spoilage. This undesirable situation can be avoided in fisheries holding several auctions of various catches in one day.

In certain areas fish are sold by sample, and this method avoids the exposure of the catch on the market without ice, as the fish can remain on board until transport is available to take it immediately to the processor or merchant. It is difficult, where large quantities of fish are being weighed into market containers, to ensure adequate icing. Here again fish boxed and iced at sea, and unloaded and distributed in the boxes, have a distinct advantage.

92. FINELY DIVIDED ICE SHOULD BE WELL DISPERSED AMONG THE FISH WHEN FILLING MARKET CONTAINERS.

Top and bottom icing should be used with more ice dispersed through smaller fish. Bottom icing will retard conduction of heat from the market floor and top icing prevents drying, cools and protects the fish. Even where proper icing is not practicable a layer of finely divided top ice is better than no ice at all.

93. FISH OFFERED FOR SALE ON THE MARKET SHOULD BE GRADED AND SORTED SO THAT ALL FISH IN A CONTAINER ARE OF SIMILAR SPECIES, SIZE AND QUALITY.

Care in grading, weighing and sorting ensures that all fish in a container are uniform in species, size and quality. This will result in the use of better quality fish to the best advantage and can help to retain the confidence of the buyer.

94. WALKING ON OR KICKING FISH AND WALKING OVER BOXES IN THE MARKET SHOULD BE DISCOURAGED.

Rough careless handling or exposure to contamination may reduce the quality of fish through physical damage or increased spoilage.

95. INSPECTION PROCEDURES SHOULD NOT INVOLVE DELAYING THE SALE OF THE CATCH.

Inspection should be carried out quickly and to good technological standards. It should not involve additional steps in the handling chain, resulting in a temperature rise of the fish.

96. BOXES SHOULD NOT BE EMPTIED OUT ON THE MARKET FLOOR FOR EXAMINATION.

This involves the risk of contamination from unclean surfaces. If fish are graded and sorted properly, then only one of the top fish in a box or batch need be inspected.

97. FISH SHOULD BE REMOVED FROM THE MARKET IMMEDIATELY AFTER THE SALE.

Distributors and processors should arrange to remove their fish immediately following the sale, and where necessary ice should be added quickly.

Some observations have shown that even in temperate climates the temperature of uniced fish, exposed while lying on market floors or similar places, may rise to as high as 16°C (61°F) at the top of containers. It has already been explained that fish will spoil very rapidly at these temperatures.

98. THE FISH SHOULD AT ALL TIMES BE KEPT CHILLED AND MOVED THROUGH THE PROCESSING CHAIN QUICKLY.

Distributors and processors should realise that the fish they receive is usually at least one day, and often several days old. It should therefore be handled as a highly perishable food and when it cannot be dealt with immediately, it should be packed in ice, in clean containers. Where possible these iced containers should be stored in a chill room.

In some cases refrigerated sea water or refrigerated brine storage may be satisfactory, provided that the fish are not cooled below -1°C (30°F). Fish should not be stored in this way for more than a day or so.

99. SOME WHOLE FISH MAY REQUIRE GUTTING ON ARRIVAL AT THE PROCESSING PLANT. THIS OPERATION SHOULD BE CARRIED OUT EFFICIENTLY AND WITH CARE.

Whether mechanical or manual methods are used, gutting must be complete in order to remove sources of fish spoilage.

100. BEFORE PACKING, ALL FISH SHOULD BE THOROUGHLY WASHED USING COOL POTABLE WATER. THE FISH SHOULD NOT BE EXPOSED TO ANY WARMING EFFECTS OF THE WATER FOR LONG PERIODS. AFTER WASHING, THE FISH SHOULD BE DRAINED PROPERLY.

Washing will remove all traces of slime, blood and gut particles which may contaminate the flesh. Leaving fish in washing water for long periods will accelerate spoilage due to temperature rise. If the fish are not drained, but packed while very wet, excessive ice meltage will take place in the box.

101. ADEQUATE QUANTITIES OF FINELY DIVIDED ICE SHOULD BE USED IN PACKING FISH FOR TRANSPORT. THE ICE SHOULD BE WELL DISPERSED AMONGST THE FISH AND SHOULD ALSO SURROUND IT IN SUFFICIENT AMOUNTS TO KEEP IT OUT OF CONTACT WITH THE BOX SURFACES DURING THE JOURNEY.

The amount of ice required when packing will depend on the length of journey and the ambient temperatures involved. The ice should always be more than enough to last the journey. A suggested minimum is one part of ice to three parts of fish. If the ice is well mixed through the load and surrounding it, then deterioration of fish quality due to rise of temperature will be minimized.

102. FOR TRANSPORT TO THE VARIOUS OUTLETS, BOXES OF ICED FISH SHOULD BE LOADED IN INSULATED VANS AND SHOULD BE STACKED CLOSE TOGETHER, TO PRESENT AS LITTLE SURFACE AS POSSIBLE FOR HEAT ABSORPTION. A LAYER OF ICE BELOW AND ON TOP OF THE STACK OF BOXES FOR ADDITIONAL COOLING IS OF FURTHER BENEFIT. IF POSSIBLE THE VEHICLE CONTAINER SHOULD BE PRE-COOLED BEFORE LOADING STARTS.

Heat flows from regions of higher temperature to those of lower temperature and will thus enter the boxes of fish through surfaces which are exposed to warmer surroundings. It follows that the rate at which heat flows into a load of stacked boxes may be reduced by minimizing the total box surface area exposed. This can be done by stacking boxes compactly and by placing a layer of finely divided ice around the stack wherever practicable.

Insulation will, of course, reduce the amount of heat leak into the vehicle container, particularly during warm, sunny weather. This in turn will reduce excessive ice meltage. In warm climates, ice packed with the fish in large transport containers may be quickly depleted, if the containers themselves are not initially cooled. The difficulty here is that the time taken to load the vehicle often nullifies the effect of any pre-cooling operation.

In many areas where container transport is not available, and short distances are involved, open vehicles are used. Fish boxes stacked on these should be surrounded with ice and covered by canvas or tarpaulin.

103. WHERE FISH IS TRANSPORTED IN VEHICLES HAVING MECHANICALLY REFRIGERATED CONTAINERS, THE COLD AIR SHOULD BE CIRCULATED COMPLETELY ROUND THE LOAD. THE TEMPERATURE SHOULD BE MAINTAINED SLIGHTLY ABOVE THE MELTING POINT OF ICE, SO THAT SOME ICE MELT-WATER IS ALWAYS COOLING THE FISH, AND TO AVOID PARTIAL FREEZING OF THE OUTER LAYERS OF FISH.

The prime function of the cold air is to absorb heat entering through the walls of the container. If the free passage of cold air is obstructed by boxes, there is a risk that part of the load will become warm. Temperatures slightly above the melting point of ice are fairly easy to control automatically therefore there should be no damage through partial freezing. It should be borne in mind that refrigerated vehicles are not meant to cool the loads. Their purpose is to maintain the load in a cool condition after it has been chilled with ice.

Handling of fillets and similar products

104. FISH WHICH CANNOT BE PROCESSED IMMEDIATELY ON ARRIVAL AT THE FACTORY SHOULD BE WELL ICED IN CLEAN CONTAINERS AND STORED IN SPECIALLY DESIGNATED AREAS WITHIN THE PLANT, WHERE THEY WILL BE PROTECTED FROM HEAT AND WEATHER CONDITIONS, AND WILL NOT BE CONTAMINATED BY DUST, INSECTS OR VERMIN. WHERE POSSIBLE THE ICED FISH SHOULD BE STORED IN A CHILL ROOM, THE TEMPERATURE OF WHICH IS JUST ABOVE THAT OF MELTING ICE 0°C (32°F)

In order to produce good quality fillets or similar products, the quality of the fish must be maintained by protecting it from heat, contamination from other sources, and physical damage.

It must be stressed again that placing quantities of fish in a chill room does not remove the need for adequate icing. Chill rooms are designed to maintain a chill temperature and to keep already cool fish from warming up. The refrigeration machinery used in chill room operation is not adequate to lower the temperature of a mass of fish in a short time. The initial cooling must be done by the addition of ice.

105. ALL FISH SHOULD BE CAREFULLY SORTED BEFORE THEY ARE FILLETED OR PROCESSED IN A SIMILAR MANNER. ANY DAMAGED, CONTAMINATED, OR OTHERWISE UNACCEPTABLE FISH SHOULD BE DISCARDED.

As has already been stated, the quality and keeping time of fillets and similar products is largely dependent on the quality of the fish from which they are produced.

Fish which are damaged will produce poor, unacceptable fillets, and if contaminated in any way can spread this contamination to working surfaces and other fillets.

106. ALL FISH SHOULD BE THOROUGHLY WASHED BEFORE BEING PLACED ON THE FILLETING AND CUTTING TABLES. SOME SPECIES MAY REQUIRE SCALING AND SHOULD BE WASHED AFTER THIS OPERATION.

Spoilage bacteria comes mainly from the surfaces of the fish being processed. Experience has shown that as much as 98 percent of the surface bacteria can be removed by proper washing.

The removal of scales from certain species is sometimes required, particularly if they are to be marketed as unskinned fillets. Fish should be well washed after scaling, otherwise loose scales adhering to the surfaces may find their way on to the fillets, thus detracting from their appearance.

107. AFTER CUTTING, THE FILLETS OR SIMILAR PRODUCTS SHOULD BE PLACED DIRECTLY ON CLEAN CONVEYORS OR INTO CLEAN CONTAINERS. PILING LARGE QUANTITIES IN ONE CONTAINER SHOULD BE AVOIDED.

Wherever possible during processing, unskinned fillets should be transferred individually by conveyor so that contact between skin and other fillets can be largely avoided, thus reducing the risk of spoilage contamination.

108. IN ORDER TO PRESERVE THE QUALITY AND KEEPING TIME OF FILLETS AND STEAKS, THEY SHOULD BE MAINTAINED AS COOL AS POSSIBLE THROUGHOUT THE WHOLE OF THE PROCESSING OPERATIONS. ALL THE WORK SHOULD BE CARRIED OUT WITH CARE, AS QUICKLY AS POSSIBLE, THERE BEING NO UNNECESSARY DELAY BETWEEN THE TIME THE FISH ARE CUT AND THE TIME THE FILLETS OR SIMILAR PRODUCTS ARE AGAIN IN A COOL CONDITION.

It is inevitable that the fillet or similar product temperatures will rise between the time that the gutted fish are taken out of chilled storage and the time the finished products can again be placed in chilled conditions. Fillet temperatures of 10°C (50°F) or higher are not uncommon even in temperate climates. While cold potable water, used for washing, and cold dip solutions will assist in keeping fillet and steak temperatures down, even these slight warming effects can be reduced by quick and efficient operations.

109. FILLETS AND SIMILAR PRODUCTS SHOULD BE PROPERLY CHILLED BEFORE BEING PACKED FOR SHIPMENT.

If there should be any delay in packing, pre-cooling the product will conserve ice used to pack the box. Individual or thin layers of fillets will cool more rapidly than those in bulk quantities. In some cases fillets or similar products may be chilled by brief immersion in an ice and water mixture. Satisfactory chilling by short exposure to a temperature of about -5°C (23°F) has also been reported. Great care must be taken in this case, however, to avoid damage by partial freezing.

110. FILLETS AND SIMILAR PRODUCTS WHICH HAVE NOT BEEN COOLED BEFORE PACKING SHOULD BE PACKED SO THAT NO PART OF ANY FILLET IS MORE THAN 4 cm ($1\frac{1}{2}$ in) FROM ICE OR OTHER SUITABLE COOLING MEDIUM.

Fish flesh is a poor conductor of heat and the rate at which fillets can be cooled decreases considerably if the depth of the layer in which they are packed is increased. It is known that the centre of a 7.5 cm (3 in) layer of fillets, initially at 4.4°C (40°F) and iced top and bottom, will cool to 1.7°C (35°F) in $1\frac{1}{2}$ hours. Under similar conditions a time of 8 hours is required for the centre of a 15 cm (6 in) layer to reach the same temperature.

111. FILLETS AND SIMILAR PRODUCTS SHOULD BE PACKED FOR TRANSPORT SO THAT THERE IS NO DIRECT CONTACT WITH ICE OR MELT-WATER. WET-STRENGTH PAPER OR PLASTIC FILMS SHOULD BE USED TO WRAP THE PRODUCTS AND SEPARATE THEM FROM ICE USED IN PACKING.

Immediately after weighing, packaging should be carried out quickly and efficiently. Prolonged contact with ice or melt-water may result in the leaching away of flavour and nutrient constituents, a softening of the texture and spoilage of surface appearance.

Technical and commercial developments have resulted in a wide variety of materials and styles of packing being used for the distribution of fillets. These range from bulk shipments of unwrapped fillets to various types and sizes of package, including hermetically sealed self-service packs with a specified shelf life. While ice packed in the same container with the fillets, but not in direct contact with them, is still the most common method of maintaining a chilled condition during transport, other methods are being introduced. Dry ice or pre-chilled eutectic solutions, in plastic or metal containers, are used in master containers having good insulating properties. Carefully controlled mechanical refrigeration is also used. Transport facilities are similar to those already recommended for gutted fish.

Whatever the method employed it is most important that fillets and similar products are protected from contamination, in some circumstances from dehydration, and are always kept as near as possible to the temperature of melting ice until they reach the consumer.

112. BOXES FOR FILLETS AND SIMILAR PRODUCTS SHOULD BE HANDLED VERY CAREFULLY DURING TRANSPORT AND DISTRIBUTION. THEY SHOULD NEVER BE UP-ENDED.

In some areas, boxes may be handled and stacked many times during distribution. Handling practices are often very rough, due to shortage of time at transfer points, and use of outdated methods for handling large quantities of boxes. It should be borne in mind that these boxes contain food for human consumption and modern handling techniques require to be introduced to avoid damage which may result in contamination of the packed product. Boxes should never be up-ended as this can result in fillet distortion and creasing and may cause loss of weight through excessive pressure on fillets at the bottom. It may also contaminate the fillets with ice melt-water.

APPENDIX 1

JOINT FAO/WHO CODEX ALIMENTARIUS COMMISSION

Recommended International Code of Practice

General Principles of Food Hygiene^{1/}

SECTION I - SCOPE

This document is intended to provide a basis for establishing Codes of Hygienic Practice which will ensure uniformity in the hygienic handling of individual commodities.

The scope of each commodity Code of Hygienic Practice for a commodity or group of commodities should carefully delineate the product(s) involved and the operations to be covered. Raw materials intended for extraction or other destructive refining purposes need only be covered to the extent required adequately to safeguard the hygienic quality of the end product.

SECTION II - DEFINITIONS

Definitions should enumerate and define those terms unique to the products included, their production and distribution. The number of definitions used should be no more than needed to assure uniform interpretation of requirements. Where possible, consistency between Codes of Hygienic Practice should be maintained.

SECTION III - RAW MATERIAL REQUIREMENTS

A. Environmental Sanitation in Growing and Raw Food Material Production Areas

1. Sanitary disposal of human and animal wastes. Adequate precautions should be taken to ensure that human and animal wastes are disposed of in such a manner as not to constitute a public health or hygienic hazard and extreme care should be taken to protect products from contamination with these wastes, particularly those products that may be consumed without heat treatment.
2. Sanitary quality of irrigation water. Water used for irrigation should not constitute a public health hazard to the consumer through the product.
3. Animal, plant pest and disease control. Where control measures are undertaken, treatment with chemical, biological or physical agents should be done only in accordance with the recommendations of the appropriate official agency, by or under the direct supervision of personnel with a thorough understanding of the hazards involved, including the possibility of toxic residues being retained by the crop.

B. Sanitary Harvesting and Production of Raw Food Materials

1. Equipment and product containers. Equipment and product containers should not constitute a hazard to health. Containers which are re-used should be of such material and construction as will facilitate thorough cleaning, and should be so cleaned and maintained as not to constitute a source of contamination to the product.

^{1/} These general principles apply to all food harvesting and processing. Section III A, parts 2. and 3. and Section III B, part 3. do not directly apply to fish processing.

2. Sanitary techniques. Harvesting and production operations, methods and procedures should be clean and sanitary.
3. Removal of obviously unfit materials. Unfit products should be segregated during harvesting and production to the fullest extent practicable and should be disposed of in such a place and in such a manner that they cannot result in contamination of the food and water supplies or other crops.
4. Protection of product from contamination. Suitable precautions should be taken to protect the raw product from being contaminated by animals, insects, vermin, birds, chemical or microbiological contaminants or other objectionable substances during handling and storage. The nature of the product and the methods of harvesting will indicate the type and degree of protection required.

C. Transportation

1. Facilities. Conveyances for transporting the harvested crop or raw product from the production area, place of harvest or storage should be adequate for the purpose intended and should be of such material and construction as will permit thorough cleaning and should be so cleaned and maintained as not to constitute a source of contamination to the product.
2. Handling procedures. All handling procedures should be such as will prevent the product from being contaminated. Extreme care should be taken in transporting perishable products to prevent spoilage or deterioration. Special equipment - such as refrigeration equipment - should be used if the nature of the product or distances involved so indicate. If ice is used in contact with the product, it should be of sanitary quality as required in Section IV - A - 2.(c).

SECTION IV - PLANT FACILITIES AND OPERATING REQUIREMENTS

A. Plant Construction and Layout

1. Location, size and sanitary design. The building and surrounding area should be such as can be kept reasonably free of objectionable odours, smoke, dust, or other contamination; should be of sufficient size for the purpose intended without crowding of equipment or personnel; should be of sound construction and kept in good repair; should be of such construction as to protect against the entrance and harbouring of insects or birds or vermin; and should be so designed as to permit easy and adequate cleaning.
2. Sanitary facilities and controls:
 - (a) Separation of processes. Areas where raw materials are received or stored should be so separated from areas in which final product preparation or packaging is conducted as to preclude contamination of the finished product. Areas and compartments used for storage, manufacture or handling of edible products should be separate and distinct from those used for inedible materials. The food handling area should be completely separated from any part of the premises used as living quarters.

- (b) Water supply. An ample supply of cold water should be available and an adequate supply of hot water where necessary. The water supply should be of potable quality. Standards of potability shall not be less than those contained in the "International Standards for Drinking Water", World Health Organization, 1963.
- (c) Ice. Ice should be made from water of potable quality and should be manufactured, handled, stored and used, so as to protect it from contamination.
- (d) Auxiliary water supply. Where non-potable water is used - for such purposes as fire control - it must be carried in completely separate lines, identified preferably by colour and with no cross-connection or backsiphonage with the lines carrying potable water.
- (e) Plumbing and waste disposal. All plumbing and waste disposal lines (including sewer systems) must be large enough to carry peak loads. All lines must be water-tight and have adequate traps and vents. Disposal of waste should be effected in such a manner as not to permit contamination of potable water supplies. The plumbing and the manner of waste disposal should be approved by the official agency having jurisdiction.
- (f) Lighting and ventilation. Premises should be well lit and ventilated. Special attention should be given to the venting of areas and equipment producing excessive heat, steam, obnoxious fumes or vapours, or contaminating aerosols. Good ventilation is important to prevent both condensation (which may drip into the product) and mold growth in overhead structures - which growth may fall into the food. Light bulbs and fixtures suspended over food in any step of preparation should be of the safety type or otherwise protected to prevent food contamination in the case of breakage.
- (g) Toilet-rooms and facilities. Adequate and convenient toilets should be provided and toilet areas should be equipped with self-closing doors. Toilet rooms should be well lit and ventilated and should not open directly into a food handling area. They should be kept in a sanitary condition at all times. There should be associated hand-washing facilities within the toilet area and notices should be posted requiring personnel to wash their hands after using the toilet.
- (h) Hand-washing facilities. Adequate and convenient facilities for employees to wash and dry their hands should be provided wherever the process demands. They should be in full view of the processing floor. Single-use towels are recommended, where practicable, but otherwise the method of drying should be approved by the official agency having jurisdiction. The facilities should be kept in a sanitary condition at all times.

B. Equipment and Utensils

1. Materials. All food contact surfaces should be smooth; free from pits, crevices and loose scale; non-toxic; unaffected by food products; capable of withstanding repeated exposure to normal cleaning; and non-absorbent unless the nature of a particular and otherwise acceptable process renders the use of a surface, such as wood, necessary.
2. Sanitary design, construction and installation. Equipment and utensils should be so designed and constructed as will prevent hygienic hazards and permit easy and thorough cleaning. Stationary equipment should be installed in such a manner as will permit easy and thorough cleaning.
3. Equipment and utensils. Equipment and utensils used for inedible or contaminating materials should be so identified and should not be used for handling edible products.

C. Hygienic Operating Requirements

While additional and more specific requirements may be established for certain products, the following should apply as minimal in all food production, handling, storage and distribution:

1. Sanitary maintenance of plant, facilities, and premises. The building, equipment, utensils and all other physical facilities of the plant should be kept in good repair and should be kept clean and maintained in an orderly, sanitary condition. Waste materials should be frequently removed from the working area during plant operation and adequate waste receptacles should be provided. Detergents and disinfectants employed should be appropriate to the purpose and should be so used as to present no hazard to public health.
2. Vermin control. Effective measures should be taken to protect against the entrance into the premises and the harbourage on the premises of insects, rodents, birds or other vermin.
3. Exclusion of domestic animals. Dogs, cats and other domestic animals, should be excluded from areas where food is processed or stored.
4. Personnel health. Plant management should advise personnel that any person afflicted with infected wounds, sores, or any illness, notably diarrhoea, should immediately report to management. Management should take care to ensure that no person, while known to be affected with a disease capable of being transmitted through food, or known to be a carrier of such disease micro-organisms, or while afflicted with infected wounds, sores, or any illness, is permitted to work in any area of a food plant in a capacity in which there is a likelihood of such person contaminating food or food-contact surfaces with pathogenic organisms.
5. Toxic substances. All rodenticides, fumigants, insecticides or other toxic substances should be stored in separate locked rooms or cabinets and handled only by or under the direct supervision of personnel with a thorough understanding of the hazards involved, including the possibility of contamination of the product.

6. Personnel hygiene and food handling practices:

- (a) All persons working in a food plant should maintain a high degree of personal cleanliness while on duty. Clothing, including suitable headdress, should be appropriate to the duties being performed and should be kept clean.
- (b) Hands should be washed as often as necessary to conform to hygienic operating practices.
- (c) Spitting, eating and the use of tobacco or chewing gum should be prohibited in food handling areas.
- (d) All necessary precautions should be taken to prevent the contamination of the food product or ingredients with any foreign substance.
- (e) Minor cuts and abrasions on the hands should be appropriately treated and covered with a suitable waterproof dressing. Adequate first-aid facilities should be provided to meet these contingencies so that there is no contamination of the food.
- (f) Gloves used in food handling should be maintained in a sound, clean and sanitary condition; gloves should be made of an impermeable material except where their usage would be inappropriate or incompatible with the work involved.

D. Operating Practices and Production Requirements

1. Raw material handling:

- (a) Acceptance criteria. The raw material should not be accepted by the plant if known to contain decomposed, toxic or extraneous substances which will not be removed to acceptable levels by normal plant procedures of sorting or preparation.
- (b) Storage. Raw materials stored on the plant premises should be maintained under conditions that will protect against contamination and infestation and minimize deterioration.
- (c) Water. Water used for conveying raw materials, including sea water for the conveyance of fish and other marine products into the plant should be from such a source or suitably treated as not to constitute a public health hazard and should be used only by permission of the official agency having jurisdiction.

2. Inspection and sorting. Prior to introduction into the processing line, or at a convenient point within it, raw materials should be inspected, sorted or culled as required to remove unfit materials. Such operations should be carried out in a clean and sanitary manner. Only clean, sound materials should be used in further processing.

3. Washing or other preparation. Raw materials should be washed as needed to remove soil or other contamination. Water used for such purposes should not be recirculated unless suitably treated to maintain it in a condition as will not constitute a public health hazard. Water used for washing, rinsing or conveying final food products should be of potable quality.

4. Preparation and processing. Preparatory operations leading to the finished product and the packaging operations should be so timed as to permit expeditious handling of consecutive units in production under conditions which would prevent contamination, deterioration, spoilage, or the development of infectious or toxigenic micro-organisms.
5. Packaging of finished product:
 - (a) Materials. Packaging materials should be stored in a clean and sanitary manner and should not transmit to the product objectionable substances beyond limits acceptable to the official agency having jurisdiction and should provide appropriate protection from contamination.
 - (b) Techniques. Packaging should be done under conditions that preclude the introduction of contamination into the product.
6. Preservation of finished product. Methods of preservation and necessary controls should be such as to protect against contamination, infestation, or development of a public health hazard and against deterioration within limits of good commercial practice.
7. Storage and transport of finished product. The finished product should be stored and transported under such conditions as will preclude the contamination with, or development of pathogenic or toxigenic micro-organisms or infestation and protect against deterioration of the product or of the container.

E. Sanitation Control Programme

It is desirable that each plant in its own interest designate a single individual, whose duties are preferably divorced from production, to be held responsible for the cleanliness of the plant. His staff should be a permanent part of the organization and should be well trained in the use of special cleaning tools, methods of disassembling equipment for cleaning, and in the significance of contamination and the hazards involved. Critical areas, equipment and materials should be designated for specific attention as part of a permanent sanitation schedule.

F. Laboratory Control Procedures

In addition to any control by the official agency having jurisdiction, it is desirable that each plant in its own interest should have access to laboratory control of the sanitary quality of the products processed. The amount and type of such control will vary with the food product as well as the needs of management. Such control should reject all foods that are unfit for human consumption. Analytical procedures used should follow recognized or standard methods in order that the results may be readily interpreted.

SECTION V - END PRODUCT SPECIFICATION

Microbiological, chemical, physical or extraneous materials specifications may be required depending upon the nature of the food. Such specifications should include sampling procedures, analytical methodology, etc., as required for the particular product.

APPENDIX 2

RECOMMENDATIONS ON THE DESIGN OF WET FISH PROCESSING PLANT

1. Buildings should preferably be constructed so that wet fish handling is carried out on the ground floor. This makes drainage easier and material handling can be assisted by simple conveyor systems.

2. Floors should be non-porous, washable, non-slip, well drained and resistant to attack from brine, weak ammonia, fish oils and offal. Concrete can be affected by animal oils and by continued action of strong brines, and where used it should have a high quality finish. Special treatments are available to prevent surface dust on concrete floors.

Clay tiles make hard-wearing floors for fish working premises and should be set in suitable jointing material.

Damage to floors should be avoided by fitting trucks and trolleys with rubber wheels.

Floor finishes which have to be stuck down are usually unsuitable, as the adhesives are often affected by wet conditions and fish oils. Oils can also cause deterioration in asphalt.

Loading bays may require special attention, where heavy traffic is involved, and metal tiles or similar reinforcement is recommended.

Hard smooth surfaces are easily cleaned, but can be very slippery, especially when wet, and a certain amount of ribbing may be necessary. Any grooving of this nature should always run towards a drain.

Floors should be constructed so that there is no possibility of stagnant pools of liquid collecting and drainage channels should be fitted with removable gratings, to permit brushing. Main drains should connect to sewers via intermediate traps and should be large enough to deal with all waste water without choking or flooding. Traps should be accessible and easy to clean.

All junctions between floors and walls should be coved, there being no corners or projections which are difficult to clean.

3. Walls should be smooth and waterproof. Brickwork or concrete blocks are satisfactory as a base for a smooth washable finish. A good finish is obtained with ceramic tiles fitted to a height of about 1 metre (3 to 4 ft) with a cement-based finish above. Top tiles should have rounded edges or the tiling made flush with the upper surface.

As with floors, the walls should be free from projections, and all pipes and cables should be ducted. Corners between adjoining walls ought to be rounded. Water paints are not suitable for decorative finishes, but cement paints and chlorinated paints wear well, where frequent hosing is involved. Epoxy, urethane and neoprene paints are also available for this type of surface. The use of light colours is advised, as this will simplify inspection of cleanliness standards.

4. Ceilings should be smooth with surface finish similar to the walls. In buildings where roof space contains trusses, beams and other projections, the fitting of a suspended ceiling just below these is an advantage. To prevent condensation the upper space should be well ventilated.

Where the roof beams and trusses cannot be covered in, paints should be chosen carefully, depending on the material to be coated. Aluminium structures will cost more initially but will require no further treatment other than regular cleaning.

5. Doors and windows should have frames of non-porous, non-absorbent material. Flush surfaces are easier to keep clean and doors should all be of a self-closing type. Window frames should be well painted so that pitting and corrosion will not occur with frequent hosing and cleaning. In many areas, insect-proof screens are required on all doors and windows.
6. Good lighting facilities will allow workers to do their tasks properly and will expose dirty surfaces. Maximum use should be made of natural light sources by fitting adequate windows.
7. Good ventilation arrangements should be incorporated, as fish plants are usually humid. This will reduce condensation, dust and objectionable smells. Special roof vents or exhaust fans are preferable to merely opening windows.
8. All plant and fish working equipment should be accessible and easy to clean. Benches and tables should be made of non-corrodible metal and the use of wood should be discouraged. Where wood is used for cutting surfaces it requires to be a hardwood. Hardened rubbers have been recommended for use as cutting surfaces. Containers and trays should be of stainless steel, aluminium alloy or plastic.
9. All power points should be properly earthed and made waterproof.
10. A generous supply of hot potable water is required for washing floors, walls, ceilings and equipment and ample cold potable water is required for cleaning the product.
11. The outer yard area should have an easily drained impervious surface. Where boxes are washed and stored the walls should have a cement-based finish to a height of about 1.5 metres (5 ft). Boxes should be stored in a clean, dry place, if possible under cover.
12. Offal should be stored well away from the main processing area and it should be contained in bins with close fitting lids. Arrangements should be made to remove it from the premises at least once daily.

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